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Field Measurement of Age in Quaking Aspen in the Central Rocky Mountains

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ORIGINAL

Aspen rings can be reliably counted without resorting to laboratory procedures by using a low-power microscope and simple field preparation of cores.

Keywords: *Populus tremuloides*, growth rings, age measurement

Introduction

The measurement of tree age from increment cores is necessary to estimate productivity or update inventories of forest stands. On-site determination of age in diffuse porous hardwoods such as quaking aspen (*Populus tremuloides* Michx.) is difficult. Suppressed growth or the occurrence of false rings compound this problem.

Researchers have traditionally collected aspen cores in the field and later measured them under laboratory conditions. Rewetting was often necessary to compensate for desiccation or to enhance structural visibility. Various combinations of the following steps have been recommended: (1) shaving the increment core; (2) air- or oven-drying the core; (3) rewetting the core and (4) examining the core under a microscope with various sources of light. The method described here uses steps 1 and 4 with specific recommendations, but differs in that age is measured in the field on fresh cores, thus eliminating the need for steps 2 and 3.

Previous Techniques

Shaving cores to enhance ring visibility has been recommended by many authors. Jones (1966), Trujillo (1975), Maeglin (1979), and Campbell (1981) used a vise to stabilize their cores while shaving one side with a sharp utility knife or razor blade. Maini and Coupland (1964) cut thin freehand sections from each core with a razor blade.

In the latter study, cores were rewet with water under low pressure and examined microscopically using transmitted light. This laboratory analysis was necessary to identify false rings caused by interrupted growth in the prairie climate of their aspen study. Brace (1966) showed that rewetting aspen cores with water nearly eliminated the radial shrinkage that caused underestimation of basal area and volume growth. Jones (1967) and Svoboda and Gullion (1972) also recommended rewetting aspen cores with water for laboratory analysis.

More complicated wetting and staining solutions have been recommended by authors such as Rose (1957) and Jones (1967), who impregnated cores with light oil. Jones (1967) also experimented with benzidine, kerosene, and saliva. Trujillo (1975) treated cores with a 4% solution of pentachlorophenol in kerosene or mineral spirits between two sessions of oven-drying. Archibold and Wilson (1978) immersed air-dry cores in hot black coffee for approximately 1 minute prior to examination. A wetting solution of water, methyl alcohol, and laboratory detergent was used by Campbell (1981).

Monocular microscopes were used by Rose (1957), with X 13 magnification, and Maini and Coupland (1964), with X 110 or X 475 magnification. Jones (1967), Trujillo (1975), and Campbell (1981) all used binocular microscopes; those of the latter two ranged between X 7 and X 13 magnification.

Most researchers used available light for ring counts with a microscope or the unaided eye. Svoboda and Gullion (1972) constructed an annual ring illuminator for their ocular counts using a 75-watt incandescent bulb under a thin slit in an otherwise lightproof box. Campbell (1981) felt fluorescent lighting above and below the microscope stage gave the best results.

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New Measurement Technique

The technique presented here draws heavily on that of Jones (1966, 1967) with several modifications, including field use of a monocular or binocular microscope. The principal advantage over other methods is that all measurement is done on fresh cores. This eliminates problems with core breakage, loss, desiccation, and deterioration due to fungal infection. Additional accuracy is gained through immediate collection of supplemental cores if age discrepancies are found.

Core Collection

The accuracy of any method depends upon the use of proper mensurational technique in obtaining increment cores representative of the true age and growth of the stem. Campbell (1981) discusses reaction wood and appropriate tree-boring procedure. Correct location of the core sample and inclusion of the pith are a necessity. Cores should be extracted with a sharp increment borer. A comprehensive description of increment borer care can be found in Haeglin (1979).

If cores from several trees are removed at one time, they may be carried in numbered plastic drinking straws with one end sealed (Cole 1977, Campbell 1981). This retains natural moisture during the brief period before measurement, keeps cores in the proper tree sequence, and reduces breakage. Figure 1 shows an easily constructed increment core carrier. Cores that disintegrate because of rot should be resampled at a different location on the stem. Ring counts should not be attempted if a sound core cannot be obtained.

Core Preparation

An easily constructed holder may be used in place of a vise for shaving increment cores. It is also useful for assembling broken cores. The holder shown in figure 2 is made from 1/4-inch clear plastic, measuring 8 by 1-1/2 inches. A 3/4- by 1-1/2-inch stop is mounted on one end.

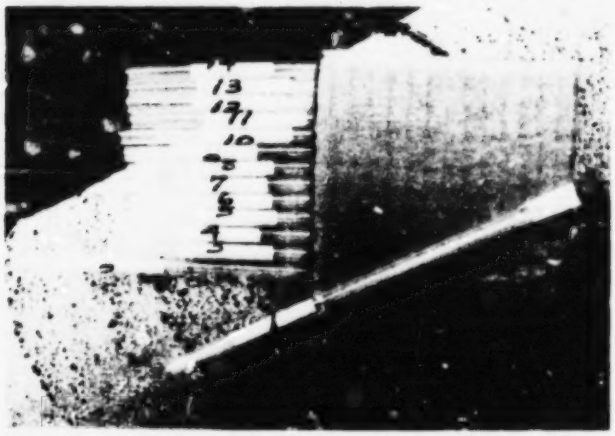

Figure 1.—Increment core carrier constructed from readily available materials.

Figure 2.—Increment core holder constructed from clear plastic.

A tapered channel, wider at the top than bottom, is cut lengthwise in the plastic. The width, angle, and depth of the channel must be adjusted to the core diameter. The size of the channel should be sufficient to firmly wedge the lower half of the increment core, leaving the upper half exposed. A suitable channel shape may be obtained by making two passes in opposite directions over an angled table saw blade. The channel should extend from the stop to the opposite end of the core holder, 1/2 inch from the right edge when viewed from the end with the stop. Those preferring to hold the utility knife in their left hand when shaving cores should make this channel 1/2 inch from the left edge.

Cores are shaved with a utility knife, as shown in figure 3. Care should be taken to orient the core so that the cut is made with the blade perpendicular to the vessels. After the top slice is removed, the flat surface should be rubbed with the side of a recently sharpened, soft (No. 1) lead pencil. This should be done in one firm motion. As figure 4 shows, this highlighting makes growth rings easily visible, even at low magnification.

Counting Rings

By placing the core holder under a X 10 magnification binocular dissecting microscope, it may be moved across the field of vision as rings are counted. Marks should be made with the No. 1 lead pencil or a water-soluble red pencil at each 10-year increment. These 10-year marks facilitate rechecking and cross-checking ring counts. Distinctive rings or sequences of rings may be compared between different cores from one tree, between cores from different trees within a stand, and between adjacent stands, to improve the accuracy of measurement (Jones 1967).

Suppressed radial growth occurs in trees near death and may occur in stands that have been defoliated by western tent caterpillar (*Malacosoma californicum*). Growth may be affected for several successive seasons, resulting in very narrow rings that are nearly indistinguishable (Rose 1957, Jones 1966). Though growth may be interrupted by drought or defoliation, false rings rarely occur in the Rocky Mountains (Campbell 1981). False

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rings may be differentiated by a gradual transition in cell size on both sides when compared to the abrupt transition from latewood to earlywood in a normal ring (Maeglin 1979). A higher power microscope may be used to discern this difference.

While a X 10 hand lens might suffice in some aspen stands, the increased accuracy and ease of core comparison afforded by a higher power microscope is necessary to differentiate very narrow or false rings. When weight is not a factor, the improved light gathering of a binocular dissecting microscope provides a more distinct view of the rings. In addition, the microscope case provides a convenient work surface.

In remote sites, recently available lightweight, portable monocular microscopes, such as the Macroscope by RF Inter-Science[2] shown in figure 5, provide an intermediate alternative between the hand lens and the binocular microscope. The internal measuring reticule can be adjusted to a 1/20-inch scale at approximately X 22, providing a convenient measuring device for 5- or 10-year radial wood growth.

[2]*The use of trade and company names is for the benefit of the reader; such use does not constitute an official endorsement or approval of any service or product by the U.S Department of Agriculture to the exclusion of others that may be suitable.*

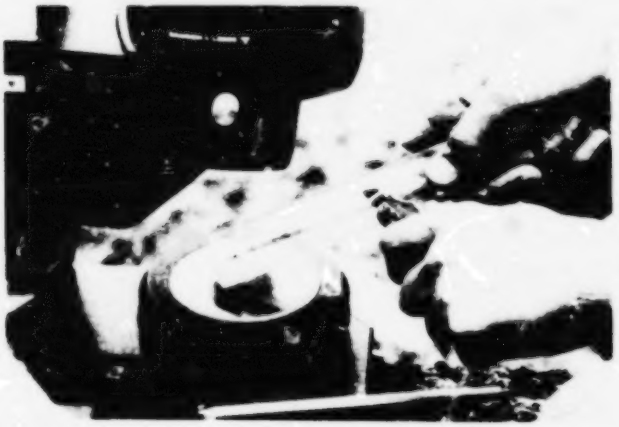

Figure 3.—Shaving an increment core.

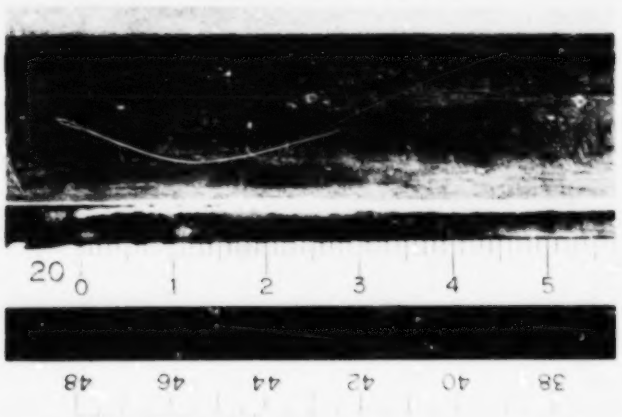

Figure 4.—Prepared increment core (shown at X 2 magnification).

Figure 5.—A variable magnification, lightweight monocular microscope.

Conclusion

The technique described here is the result of the combined experience of the authors over five field seasons. Direct comparisons with alternate methods were not made; however, this method provided repeatable results between different researchers at different times in the same field season. Ages were successfully measured in aspen stands from southern Wyoming to northern New Mexico, and from the front range of Colorado to eastern Utah. These simple techniques make possible accurate determination of aspen age in the field with minimum equipment and no chemical solutions.

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